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Utilization of LDPE Plastic Waste for Brick

A. Supriyadi[1*], E. Sutandar[1], G. Setyabudi[1], Aryanto[1], F. Juniardy[1]
[1]Faculty of Civil Engineering, University of Tanjungpura, Prof. Dr. Hadari Nawawi Pontianak street, West Kalimantan, Indonesia
Correspondent email: askhalifah900@gmail.com

Abstract— *Brick is an essential building material for quickening growth, especially in Kabupaten Ketapang, the largest district in the province of West Kalimantan at 31,580 km2. Plastic waste has a lifespan of between 500 billion and 1 trillion years. In order to support the acceleration of development in Kabupaten Ketapang, and due to the fact that plastic waste is classified as an element that is difficult to decompose and maintain the beauty of the environment, and in an effort to reduce the use of depleting natural resource materials, the innovation of using Low Density Polyethylene (LDPE) plastic waste as a mixed material for making bricks must be evaluated to determine its effectiveness. In the field, variations of 1:3 and 1:6 were used to evaluate the plastic mixture on brickwork based on SNI and PUBI. The properties of SNI-3-0349-1989 were applied in the brick mix's mix design analysis. A lighter weight was achieved by comparing the volume weight of the bricks to this plastic mixture. In accordance with SNI 16-2094-2000, the maximum compressive strength test for plastic bricks is 50.71 kgf/cm^2 at a mixture variation of 1:3. This measurement of compressive strength is 45 kgf/cm^2, which is class I. With the addition of plastic to the brick mixture, the compressive strength decreased from 24.31 kgf/cm^2 for a 10% mixture in class III to 22.85 kgf/cm^2 for a 20% mixture in class III to 12.66 kgf/cm^2 for a 40% mixture in class IV and the highest plastic brick specimen's compressive strength, which is 21.89 kgf/cm^2 at a 1:6 variation of 0 percent, falls into the third class, which is 30 kgf/ cm^2. With the addition of plastic to the brick mixture, the compressive strength decreased from 20.04 kgf/cm^2 for a 10% mixture in class III to 11.69 kgf/cm^2 for a 20% mixture in class IV to 9.20 kgf/cm^2 for a 40% mixture in class IV.*

Keywords— *Low Density Polyethylene (LDPE) plastic, SNI-3-0349-1989, SNI 16-2094-2000, plastic trash in Kabupaten Ketapang, and plastic waste bricks are the keywords for this article.*

I. INTRODUCTION

Along with the expansion of infrastructure in Kabupaten Ketapang, particularly buildings. Brick is a commonly used building material, notably for wall construction, including house/building walls and fence walls. The bricks are composed of sand, water, and cement as a binding agent. The hydration produced by the cement and water bonds the fine aggregate grains (sand) together. The strength of bricks is mostly governed by the reaction between cement and water for optimal sand strength. In addition to the amount of cement used, the amount of water utilized also significantly affects the bricks' quality.

To limit the use of materials derived from nature, such as sand, natural stone, limestone, and asphalt, the most recent advances are required. These innovations strive to limit the consumption of diminishing natural resources. One of the developments in the construction industry is the utilization of trash as a resource or raw material for the production of bricks.

Plastic garbage is one of the wastes that can be repurposed. Where this plastic garbage might poison the ecosystem and cause damage. In addition, plastic does not disintegrate swiftly or slowly. It is believed that between 500 billion and 1 trillion plastics are used annually in the world, while it is known that the prevalence of plastic is growing. If this trash is spread out, it might cover at least ten times the earth's surface. It is estimated that each individual uses 170 plastic bags annually. Each year, more than 17 billion plastic bags are given away for free by supermarkets around the world. Plastic has numerous advantages, but also disadvantages, particularly plastic trash. Nevertheless, plastic trash has prospects for application in civil building construction. This plastic trash can also be utilized as a filler in the production of bricks.

Many people continue to believe that useless leftovers constitute waste. If waste is weighed in huge quantities at the final waste disposal site, it can raise greenhouse gas emissions and exacerbate global warming.

II. METHOD

II.1. Implementation Method

II.1.1. Preparation Phase

Prior to conducting the research, communication with the Regional Research and Development Agency of Kabupaten Ketapang is conducted and the following are prepared:

1. The supply of materials and equipment for field operations.
2. Provision (lease) and operation of operable vehicles.
3. Travel and lodging expenses for specialists.
4. Rent field survey equipment

In this investigation, bricks measuring 39 by 19 by 10 inches were used. The following instruments and materials are utilized in the investigation of plastic mixes of bricks:

1. Measurement cups, organic plates, containers, sieve shaker machines, ovens, pycnometers, scales, pressure test equipment, hollow brick molds, cement shovels, and sand filters are required.
2. The required raw materials are plastic scrap and used oil/lubricant.

II.1.2. Experiment Phase

In this study, the testing of the bricks is as follows:

Table 1. Example of a Test Item List

Test Object	**Pressure Test and volume weight Day-**				**Test for Water Absorption**
	7	**14**	**21**	**28**	
0% Plastic LDPE	2	2	2	2	2
10% Plastic LDPE	2	2	2	2	2
20% Plastic LDPE	2	2	2	2	2
40% Plastic LDPE	2	2	2	2	2
Amount	32				8
Total	40				

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II.1.2.1 Visual Test

1. Equipment required for external inspection: An angle ruler is used to measure the angle of each corner and the flatness of the concrete block's plane surface. The remainder of the assessment on the sharpness and tensile strength of the brick ribs are not easily crushed with finger strength.
2. Equipment required for size measurement: Used to determine the dimensions of the bricks, a long ruler or slide rule.
3. Test procedure
   After 28 days of treatment, the tested bricks must be dry. The following actions must be taken:
   a. Remove any dirt from the surface of the test object's brick exterior.
   b. Determine the object's length, width, and thickness.
   c. The surface of the test object is observed for its condition, density, and state of the corners.

II.1.2.2 Volume Weight Test

1. Equipment required for evaluating bulk density:
   a) Bricks are weighed on scales when wet with water and when oven-dried. Utilized scales with a capacity of 60 kg and 0.1 g.
   b) After soaking, the oven is utilized to dry the bricks' moisture content. The temperature range of the oven's temperature regulation is between 105°C and 110°C.
2. Test procedure:
   Dryness is required for testing the absorption of bricks. These procedures must be followed for this examination:
   a) Bricks are cleaned of any adhering substances.
   b) Dry the bricks by placing them in the oven for 24 hours per day. After collecting the appropriate information, the following formula can be used to compute the weight of the sample:

$$BV = w/v$$

   Where:
   BV = Volume Weight (Kg/m^3)
   w = Test Object Weight (gr)
   v = Volume of Examinable Object (m^3)

II.1.2.3 Brick Absorption Test

1. Required testing equipment for compressive strength:
   a) After watering, the surface of the brickwork is wiped with a rag to remove excess moisture.
   b) Bricks are weighed on scales when wet with water and when oven-dried. Scales with a capacity of 60 kg and an accuracy of 0.1 g are utilized.
   c) The slide rule is used to measure the compression area's area. The precision of a caliper is 0.01 mm.
   d) Utilized testing apparatus is a concrete compressive strength testing machine (compression machine).
2. Test procedure:
   a) The bricks were dried in the sun for 24 hours after remaining moisture was removed.
   b) Place the bricks precisely in the center of the compression machine after having them weighed.
   c) By operating the machine, the compressive load is gradually applied to the test object until the object collapses.
   d) When the scale guide needle does not rise or rises, note the scale displayed by the needle, which represents the maximum load the test object can support.
   e) Each test object was subjected to a separate experiment.
   f) Using the following formula, get the compressive strength of the bricks.

$$P = Fmax/A$$

   Where:
   P = Compressive Strength (kg/m^2) and Fmax = Maximum Load
   Fmax = Maximum Force (kg)
   A = Surface Area of the Object Under Test (cm^2)

II.1.2.4 Sample Compressive Strength Test

1. Equipment required for testing water absorption:
   a) A container containing sufficient water to completely saturate the test object with water.
   b) After soaking the brick in water, the surface is wiped clean using a rag.
   c) Bricks are weighed on scales when wet with water and when oven-dried. Scales with a capacity of 60 kg and an accuracy of 0.1 g are utilized.
   d) After soaking, the oven is utilized to dry the bricks' moisture content. The temperature range of the oven's temperature regulation is between 105°C and 110°C.
2. The process for testing absorption requires dry bricks. The procedure is as follows:
   a) Bricks are cleansed of any clinging substances.
   b) Bricks are immersed in the soaking pool for 24 hours per day.
   c) Remove the bricks from the immersion pool and remove any remaining water from the sample's surface.
   d) Weigh the bricks to determine the weight of the saturated sample.
   e) Place the bricks in the oven for twenty-four hours every day, or until the sample is dry.
   f) Weigh the bricks such that the sample weight is dry. After collecting the appropriate data, the following formula can be used to determine water absorption:

$$Wa = (Mj-Mk)/Mk \times 100\%$$

   Where:
   Wa = Adsorption of Water (%)
   Mk = Dry Body Mass (gr)
   Mj = Mass of an Object in a Saturated State (gr)

II.1.3. Experiment Phase

1. Required testing equipment for compressive strength:
   a) After watering, the surface of the brickwork is wiped with a rag to remove excess moisture.
   b) Bricks are weighed on scales when wet with water and when oven-dried. Scales with a capacity of 60 kg and an accuracy of 0.1 g are utilized.
   c) The slide rule is used to measure the compression area's area. The precision of a caliper is 0.01 mm.
   d) Utilized testing apparatus is a concrete compressive strength testing machine (compression machine).
2. Test procedure

a) The bricks were dried in the sun for 24 hours after remaining moisture was removed.
b) Place the bricks precisely in the center of the compression machine after having them weighed.
c) The bricks were dried in the sun for 24 hours after remaining moisture was removed.
d) Place the bricks precisely in the center of the compression machine after having them weighed.
e) Each test object was subjected to a separate experiment.
f) Using the following formula, get the compressive strength of the bricks.

$$P = Fmax/A$$

Where :
P = Compressive Pressure (kg/m^2)
Fmax = Maximum Force (kg)
A = Surface Area of an Object Under Test (cm^2)

II.2. Method of Collecting Data

The experimental method was used to collect data on a number of laboratory-tested test objects subjected to a variety of treatment conditions. This study distinguishes between two types of data: primary and secondary.

1. Primary Data
   Primary data is information collected directly through a series of experimental activities conducted independently, such as research or direct testing, with reference to existing manuals. Laboratory tests of volume weight, absorption, and concrete compressive strength provided the primary data for this investigation.
2. Secondary Records
   Secondary data is the data obtained indirectly (from other studies) for the same material or type that are still relevant to research.

II.3. Data Analysis Method

Method The data was collected using the Highways Method with the AC-WC specification and the Marshall Test Method (Marshall Quotient). Analyzing data from recordings and calculations of tests conducted using the Marshall Test Method, then drawing conclusions and making recommendations based on the findings. The purpose of material analysis is to determine the physical properties of a material to be used in research. Particularly when designing a brick mixture, it is necessary to conduct specialized research on the materials used in the mixture. Material analysis is performed in an effort to ascertain the required quantity for formulating the mixture. Analysis of the used materials using an ASTM C-33-based test method and calculation of the mixed design using a modified SNI 7656:2012-based method. The following materials were used in this investigation:

1. Cement
Cement is used to adhere stones, bricks, and other building materials together. The Portland cement used is brand Tiga Roda. This type of cement is available at construction supply stores in the Pontianak City area. Observations of physical and chemical properties were not carried out because Portland cement with this brand had complied with the requirements of SNI 7064:2014. Visually, cement must be in good condition, smooth, and not lumpy or hardened. Cement should be stored in a dry and protected area. The following tests will be carried out on the fine aggregate, namely: Analysis of Cement Specific Gravity and Analysis of Cement Volume Weight.
2. Fine aggregate (sand) Aggregate is one of the materials that must undergo a battery of tests to determine its properties and characteristics. Fine aggregate is a naturally occurring mineral used as a filler in concrete mixtures with a grain size of less than 5 mm or that pass the No. 4 sieve and are retained on the No. 200 sieve. Analysis of Fine Aggregate Organic Content, Analysis of Fine Aggregate Sludge Content, Analysis of Fine Aggregate Moisture Content, Analysis of Specific Gravity and Water Absorption, Gradation Analysis of Fine Aggregate, and Volume Weight Analysis of Fine Aggregate.
3. Water

The water used must meet multiple criteria, including an appearance of cleanliness and other requirements. However, the chemical composition of water was not investigated in this study. In this study, water from PDAM Pontianak that met PBI-71 requirements was utilized.

III. THE RESULTS AND DISCUSSION

III.1. Brick Visual Testing Analysis

III.1.1 Exterior Inspection

Table 2. Exterior Inspection Variation of Brick for Mixture 1:3

Information	Description	Sample State Average	According To SNI 03-0349-1989
Variation 0%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Not Crack	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Laziness	Elbow	Elbow
	b. Sharpness	Not Sharp	Sharp
	c. Strength	Strong	Strong
Variation 10%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Slightly Cracked	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Elbow	Elbow	Elbow
	b. Sharpness	Not Sharp	Sharp
	c. Strength	Strong	Strong
Variation 20%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Slightly Cracked	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Elbow	Elbow	Elbow
	b. Sharpness	Sharp	Sharp
	c. Strength	Strong	Strong
Variation 40%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Slightly Cracked	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Elbow	Elbow	Elbow
	b. Sharpness	Not Sharp	Sharp
	c. Strength	Strong	Strong

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III.1.2 Size Check

After checking the size and obtaining dimension measurement data on the brick samples, the data is then analyzed for storage of the sizes contained in the bricks in accordance with SNI 03-0349-1989 specifications.

Table 3. Exterior Inspection Variation of Brick for Mixture 1:6

Information	Description	Sample State Average	According to SNI 03-0349-1989
Variation 0%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Not Crack	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Laziness	Elbow	Elbow
	b. Sharpness	Not Sharp	Sharp
	c. Strength	Strong	Strong
Variation 10%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Slightly Cracked	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Elbow	Elbow	Elbow
	b. Sharpness	Not Sharp	Sharp
	c. Strength	Strong	Strong
Variation 20%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Slightly Cracked	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Elbow	Elbow	Elbow
	b. Sharpness	Sharp	Sharp
	c. Strength	Strong	Strong
Variation 40%	**Fields**		
	a. Flatness	Flat	Flat
	b. Rift	Slightly Cracked	Not Cracked
	c. Fine	Rough	Fine
	Ribs		
	a. Elbow	Elbow	Elbow
	b. Sharpness	Not Sharp	Sharp
	c. Strength	Strong	Strong

Table 4. Brick Hole Sizes

Adding Plastic PLDE (%)	**Dimension**			**Wall Thickness of an Open Bulkhead, Minimum**				**Test Object Volume**	**Test Object Hole Volume**	**Hole Percentage**	
				Test Object		**SNI 03-0349-1989**					
	p	**l**	**t**	**Outside**	**Inside**	**Outside**	**Inside**			**Test Object**	**SNI 03-0349-1989**
	mm	mm	mm	mm	mm	mm	mm	m^3	m^3	%	%
0	373	70	161	15	14	20	15	0.0042	0.0027	63.26	25
10	372	67	161	14	16	20	15	0.0040	0.0028	70.51	25
20	373	65	165	15	16	20	15	0.0040	0.0029	72.15	25
40	374	65	164	15	16	20	15	0.0040	0.0028	70.97	25

III.1.3 Analysis of Brick Volume Weight Test

The test results for the bulk weight of plastic bricks that were manufactured and naturally dried for 7, 14, 21, and 28 days. Generally, as shown in the table below.

Table 5. Volume Weight of 0% Variation of Brick for Mixture 1:3

No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1,430	1,515	1,440	1,457
2	Sample 2	1,500	1,452	1,429	1,457

Table 6. Volume Weight of 10% Variation of Brick for Mixture 1:3

No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1.196	1.169	1.164	1.120
2	Sample 2	1.196	1.169	1.159	1.144

Table 7. Volume Weight of 20% Variation of Brick for Mixture 1:3

No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1.222	1.126	1.110	1.170
2	Sample 2	1.232	1.105	1.114	1.148

Table 8. Volume Weight of 40% Variation of Brick for Mixture 1:3

No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1.211	1.113	1.089	1.177
2	Sample 2	1.185	1.089	1.088	1.112

Table 9. Volume Weight of 0% Variation of Brick for Mixture 1:6

No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1.06	1.17	1.057	1.04
2	Sample 2	1.11	1.09	1.019	0.99

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Table 10. Volume Weight of 10% Variation of Brick for Mixture 1:6

No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1.04	1.05	1.097	1.11
2	Sample 2	1.03	1.08	1.114	1.13

Table 11. Volume Weight of 20% Variation of Brick for Mixture 1:6

No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1.09	1.04	1.121	1.04
2	Sample 2	1.03	1.11	1.136	1.11

Table 12. Volume Weight of 40% Variation of Brick for Mix 1:6

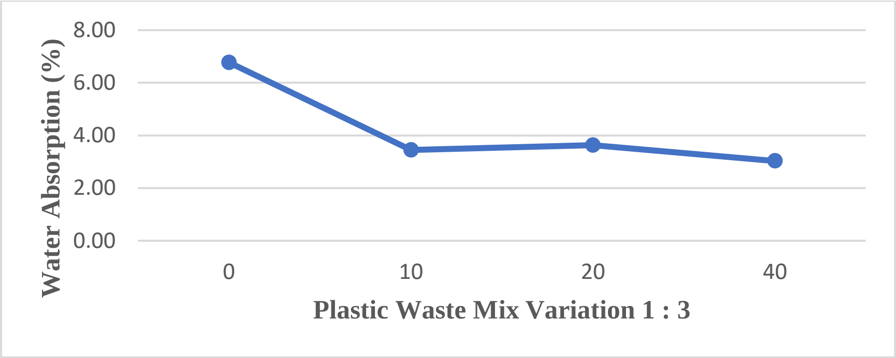
No	Information	Volume Weight (kg/cm^3)			
		7 days	14 days	21 days	28 days
1	Sample 1	1.02	1.11	1.128	0.98
2	Sample 2	1.07	1.14	1.113	1.03

III.1.4 Analysis of Testing for Brick Absorption

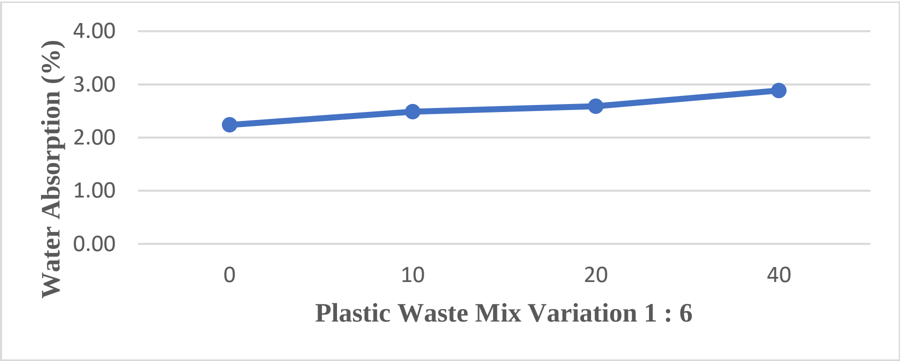
The test results for the bulk weight of plastic bricks that were manufactured and naturally dried for 7, 14, 21, and 28 days. General, as demonstrated

III.1.5 Analysis of Brick Compressive Strength Test

Testing the compressive strength of concrete is usually performed after 28 days, when the concrete's strength has reached 100 percent. In this study, the compressive strength of bricks was measured at 7, 14, 21, and 28 days of age to determine the increase in compressive strength over the test age interval. Appendix 11 illustrates the relationship between the compressive strength of plastic bricks with varying amounts of plastic bags and the age of the bricks. In general, it is displayed in the following table.



Graph 1. Water Absorption Variation 1: 3



Graph 2: Water Absorption Variation 1: 6

Table 13. Compressive strength 0% Brick Mixture Variation 1:3

Information	Compressive Strength (kgf/cm^2)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	28,90	37,14	44,70	47,42	65	45	30	17	II
Sample 2	32,08	41,99	46,35	50,71	65	45	30	17	I

Table 14. Compressive strength 10% Brick Mixture Variation 1:3

Information	Compressive Strength (kgf/cm^2)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	12.99	15.55	21.53	23.29	65	45	30	17	III
Sample 2	14.53	19.78	22.05	24.31	65	45	30	17	III

Table 15. Compressive strength 20% Brick Mixture Variation 1:3

Information	Compressive Strength (kgf/cm^2)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	6.73	14.53	18.06	19.73	65	45	30	17	III
Sample 2	8.48	16.40	19.63	22.85	65	45	30	17	III

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Table 16. Compressive strength 40% Brick Mixture Variation 1:3

Information	Compressive Strength (kgf/cm²)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	7.97	10.61	12.48	13.43	65	45	30	17	IV
Sample 2	7.99	11.88	12.66	14.49	65	45	30	17	IV

Table 17. Compressive strength 0% Brick Mixture Variation 1:6

Information	Compressive Strength (kgf/cm²)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	12.18	16.71	19.04	20.07	65	45	30	17	III
Sample 2	15.02	18.00	19.94	21.89	65	45	30	17	III

Table 18. Compressive strength 10% Brick Mixture Variation 1:6

Information	Compressive Strength (kgf/cm²)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	6.36	9.74	16.63	18.69	65	45	30	17	III
Sample 2	6.55	14.57	17.31	20.04	65	45	30	17	III

Table 19. Compressive strength 20% Brick Mixture Variation 1:6

Information	Compressive Strength (kgf/cm²)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	4.36	5.17	11.53	13.20	65	45	30	17	IV
Sample 2	4.77	9.86	11.69	13.53	65	45	30	17	IV

Table 19. Compressive strength 40% Brick Mixture Variation 1:6

Information	Compressive Strength (kgf/cm²)								Quality
	7 days	14 days	21 days	28 days	SNI 03-0349-1989				
					I	II	III	IV	
Sample 1	6.06	7.69	8.76	9.08	65	45	30	17	IV
Sample 2	6.88	8.32	8.83	9.20	65	45	30	17	IV

The compressive strength of the bricks increased with the addition of drying time and decreased with the addition of plastic bags, as shown in the table above. This is consistent with the initial hypothesis, which stated that the greater the addition of plastic bags, the lower the compressive strength.

At ages 7, 14, 21, and 28 days, the compressive strength of bricks made without a mixture of plastic bag waste or a variation of 0 percent waste addition ranged from 28.90 to 50.71 kgf/cm2 for bricks with variation 1:3 and from 12.18 to 21.89 kgf/cm2 for bricks with variation 1:6. According to SNI-03-0348-1989, these bricks can be classified as bricks of quality class II for the 1:3 variation and brick quality class III for the 1:6 variation.

The compressive strength of bricks containing 10 percent plastic bag waste varies between 12.99 and 24.31 kgf/cm2 when dried for 7, 14, 21, and 28 days at a ratio of 1:3 and after 7, 14, 21, and 28 days. In accordance with SNI-03-0348-1989, these bricks belong to the quality classes IV and III for the 28-day test age.

The compressive strength ranges from 6.36 to 20.04 kgf/cm2 for bricks containing 10% plastic bag waste with a variation of 1:6 and having been dried for 7, 14, 21 and 28 days. In accordance with SNI-03-0348-1989, these bricks belong to the quality classes IV and III for the 28-day test age.

The compressive strength ranged from 6.73 to 22.85 kgf/cm2 and 7.97 to 14.49 kgf/cm2 for bricks containing 20 percent and 40 percent by weight of plastic bag waste, respectively, and dried for 7, 14, 21, and 28 days. In SNI-03-0348-1989, bricks with a minimum average compressive strength of 21.30 kgf/cm2 can be classified as bricks with brick quality classes IV and III that contain a minimum percentage of plastic bag waste. While the addition of a 40 percent increase in the percentage of plastic bag waste is included in the Brick IV quality standard,

The compressive strength of the bricks with a percentage of plastic bag waste of 20% and 40% in the 1:6 variation, which were dried for 7, 14, 21 and 28 days, ranged from 6.06 to 9.20 kg/cm2 and 4.36 to 13.53 kg/cm2, respectively. Bricks containing between 20 and 40 percent of plastic bag waste are categorized as IV quality.

IV. Conclusion

Processing based on previous data and analysis; the following conclusions have been reached:

1. According to the results of the size test, all variations of the 1:3 and 1:6 mixtures met the specifications for bricks outlined in the SNI and PUBI.
2. For the volume weight of this plastic brick, the addition of plastic to the brick mixture results in a lighter weight, as shown in the table below. Where the volume weight of the bricks for a variation of 40% mixture 1:3 is 1,112 kg. The volume weight variation of a 40% mixture 1:3 is 0.98 kg.
3. For absorption, it satisfies the requirements for all SNI-based variations and mixtures.

4. According to SNI 16-2094-2000, the compressive strength value of the highest plastic brick test object, which was 50.71 kgf/cm^2 at a 1:3 variation of 0% mixture, falls into class I, which is 45 kgf/cm^2. With the addition of plastic to the brick mixture, the compressive strength decreased from 24.31 kgf/cm2 for a 10% mixture in class III to 22.85 kgf/cm^2 for a 20% mixture in class III to 12.66 kgf/cm^2 for a 40% mixture in class IV. According to SNI 16-2094-2000, the highest plastic brick specimen's compressive strength, which is 21.89 kgf/cm^2 at a 1:6 variation of 0 percent, falls into the third class, which is 30 kgf/ cm^2. With the addition of plastic to the brick mixture, the compressive strength decreased from 20.04 kgf/cm^2 for a 10% mixture in class III to 11.69 kgf/cm^2 for a 20% mixture in class IV to 9.20 kgf/cm^2 for a 40% mixture in class IV.

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REFERENCES

[1] Amran, Yusuf. Utilization of Plastic Waste as Additional Material for Paving Blocks as an Alternative Pavement in Parking Areas at the University of Muhammadiyah Metro. TREAT Vol. 4 No. 2015.
[2] Ministry of Public Works, Appendix no 12 (1987) Guidelines for Highway Flexible Pavement Using Component Analysis Method, Public Works Publishing Agency Foundation.
[3] Public Works Department. 1989, SNI 03-0349-1989 Concrete Brick for Wall Pairs, Balitbang Jakarta.
[4] Desi Putri, Gita Puspa Artiani, Indah Handyasari. Study of the Effect of Adding Bamboo Shavings to the Compressive Strength of Brick
[5] Glory, O. (2018). Addition of Hdpe and PP Plastic Waste on Mixed Brick Walls.
[6] Hartono, Rudi. 2008. Handling of Waste Processing. Bogor. Self-help Publisher. Retrived from http://books.google.com/books. May 12, 2019.
[7] Association of Indonesian Soil Technicians. 2015. Compressive Strength Based on Hammer Test and Compression Test on Cylindrical Test Objects.
[8] Indonesia. (2008). Law Number 18 of 2008 concerning Waste Management. State Secretariat. Jakarta
[9] Indonesia. (2012). Government Regulation of the Republic of Indonesia Number 81 of 2012 concerning the Management of Household Waste and Similar Waste of Household Waste. Jakarta
[10] Liang, W., & Nusryamsi. (2017). Analysis of the Compressive Strength of Brick with a Mixture of Glass powder and Silica Fume. USU Journal of Civil Engineering, 6(1).
[11] Mufika, Neyla Rohma. 2018. The Effect of Using Plastic Concrete for Perforated Lightweight Brick in the Test on Compressive Strength and Flexural Strength with Variations in Number and Yarn. Civil Engineering Thesis. Brawijaya University. Faculty of Engineering. Poor.
[12] Nursyamsi, Indrawan, I., Hastuty, I. P., Civil, M. T., Civil, T., Sumatra, U., Engineering, D., University, S., North, S., Engineering, D., University, S., & North, S. (2016). Utilization of Glass Powder as Additional Ingredients in Making Brick
[13] Pramono, Susatyo Adi, Tri Watiningsih and Iwan Rustendi. "Waste as Raw Material for Making Raw Stone". Proceedings, Semnas Entrepreneurship. pp. 275-294. June 2014.
[14] President of the Republic of Indonesia. Law of the Republic of Indonesia Number 18 of 2008 concerning Waste Management.
[15] Rian Putrowijoyo, (2006) Laboratory Study of Marshall Properties and Durability of Asphalt Concrete – Wearing Course (AC – WC) by Comparing the Use of Portland Cement and Stone Ash as Filler.
[16] Ricky Kusmawan, (1999) Effect of Filler Type and Aggregate Gradation on Stone Mastic Asphalt Durability, Master Thesis, UGM, Yogyakarta.
[17] Robert D. Krebs/Richard D Walker, (1971) Highway materials, McGraw – Hill Book Company.
[18] SNI 03-2834-2000, S. (2000). Indonesian National Standard Procedures for making normal concrete mix plans.
[19] SNI 15-0302-2004 Regarding Portland Pozzolan Cement
[20] SNI 19-3964-1994 concerning Methods of taking and measuring samples of generation and composition of urban waste
[21] SNI 19-3983-1995 concerning Specifications for Waste Generation in Medium and Small Towns
[22] SNI 3-0349-1989 concerning Concrete Brick for Wall Pairs
[23] SNI ASTM C 136:2012 Test Method for Sieve Analysis of Fine Aggregate and Coarse Aggregate
[24] Syria. Effectiveness of Socialization of the Office of Hygiene and Parks (DKP) of Samarinda City on Organic Waste Management. e-Journal of Communication Studies Vol 3 No. 2. 2015.
[25] Syaifuddin. (2018). Making and Testing the Compressive Strength of Brick with the Addition of Fish Bone Waste. Makassar: Alauddin State Islamic University Faculty of Science and Technology
[26] Taufiqurrahman. (2016). Optimization of Waste Management Based on Waste Generation and Characteristics in Pujon District, Malang Regency. Malang: National Institute of Technology
[27] Use of Materials as Glass Powder Added In Making Batako Nursyamsi, Ivan Indrawan, Ika Puji Hastuty.